HERBICIDES STUDY COURSE

AQUATIC VEGETATION CONTROL

Pesticides Control Section

Ontario

Ministry of the Environment

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PESTICIDES CONTROL SECTION

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ONTARIO MINISTRY OF THE ENVIRONMENT

PESTICIDES CONTROL SECTION

AQUATIC VEGETATION CONTROL

1. AQUATIC PLANT AND ALGAE CONTROL

Legislation:

Aquatic vegetation when present in nuisance proportions may decrease many facets of water use in the infested areas: fisheries, recreation, transportation. Therefore control may be desirable.

Methods of control involve mechanical, biological or (chemical) pesticide techniques. The former two methods of control, in general, have not been investigated sufficiently to permit wide-scale public usage. Therefore this study guide will confine its discussion to the safe use and sound management of pesticides as an effective temporary control method for nuisance aquatic vegetation.

Through Legislation under The Pesticides Act, 1973 and Regulations, any person applying a pesticide directly to water requires a water extermination licence, unless exempt. In general, no licence is required when the individual is treating water on his own domestic premises. In all other cases, (i.e. on crown land, commercial premises, etc.) a licence is required. For exterminations of aquatic plants or algae, this involves a Class 1 or Class 3 (endorsed) water licence. The licence training and examination programme schools individuals in safe handling and sound management of pesticide use, storage, disposal, application techniques and equipment calibration.

In addition to the licence requirement under the Act, an individual using an aquatic herbicide or algicide requires an aquatic nuisance control permit, unless exempt. Essentially no permit is required if the treated water has no outflow off the premises other than by percolation. A permit is required whenever treated surface water moves away from the treatment site and into a public water body or water course. The permit system ensures that there will be no unreasonable infringements on the rights of other water users and that substances will not be used which are toxic to humans, domestic animals, fish and other wildlife. It also ensures that stable compounds will not be used that might tend to accumulate and remain biologically active in water, thus posing a threat to potable water supplies. The aquisition of a permit does not relieve any individual from the responsibility for any undesirable consquences arising from a treatment. Anyone applying a pesticide without the authority of a mandatory permit or who violates the terms and conditions provided in a permit is guilty of an offence and liable to prosecution under The Pesticides Act, 1973 and Regulations.

For clarification of licence and permit requirements, the following examples are listed:

(a)	Licence and permit:	A cottage association proposes to treat submergents in front of a number of cottages.
(b)	Licence, no permit:	A municipality proposes to treat drainage ditches in the fall, when the ditches do not contain moving water.
(c)	Permit, no licence:	An individual cottager proposes to treat submergents around his own boat dock in a lake other than a crown lake; an individual treating algae and mixed submergents in his farm pond which has a continuous outflow.
(d)	No permit, no licence:	An individual treating algae and mixed submergents in his farm pond which has water input from run-off or springs, but has no outflow.

Licences and permits are issued on an annual basis and must be renewed, if a programme is continued or repeated the next year. Permit applications must be completed in duplicate and submitted for consideration and approval at least three weeks (but preferably earlier) prior to the time of proposed treatment, since it is often necessary to consult with field staff of the Ministry of the Environment and the Ministry of Natural Resources.

2. PROS AND CONS OF AQUATIC VEGETATION

Higher aquatic plants and algae are important in maintaining a balanced aquatic environment. However, depending on the uses made of the water, there may be situations where their presence is undesirable.

On the positive side, in addition to maintaining an oxygen balance essential to fish life, water plants provide a suitable environment for the production of aquatic invertebrate organisms which serve as food for fish. They also contribute to keeping water temperatures at the low levels essential to certain species of fish and they provide shade and protection for young game fish and forage fish species. Finally, numerous aquatic plants are utilized for food and/or protection by many species of waterfowl and other water-oriented wildlife such as beaver, muskrat and moose. Established swamps in particular should be carefully evaluated before control is considered as this type of wildlife refuge is rapidly diminishing.

On the other hand, ponds and lakes may become unsightly because of the presence of dense mats of decomposing algae. Recreational uses such as fishing, swimming or boating may be impaired by heavy accumulations of algae or thick growths of vascular aquatic plants. Decaying masses of vegetation may cause water to become less palatable to humans or to domestic livestock. Finally, winterkills of fish may result from oxygen depletion in the water caused by a decomposition of plants under the ice during certain winter seasons.

In summary, a careful assessment of the various usages and relative values of the presence or absence of aquatic plants in a particular situation should be made before any control project is undertaken.

3. TYPES OF AQUATIC PLANTS

Aquatic plants may be divided into three categories, as follows:

(1) submerged rooted aquatics - have true stems and leaves, up to the surface. Examples include: tape grass, Canada water weed, water milfoil, bladderwort and a variety of pondweeds.

(2) emergent plants - may have upright leaves or leaves which float on the surface of the water. Examples include: water lilies, water shield, cattails, bulrushes, sedges, and duckweed.

(3) algae - threadlike filaments without true leaves or stems; colour the water green or brown, or appear as "pond scum". Examples of filamentous green algae include: Spirogyra sp.and Cladophora sp. One plant-like alga often confused with rooted submergent plants is the stonewort or muskgrass group of algae which includes Nitella sp. and Chara sp.

Aquatic herbicides vary in the spectra of vegetation that they will control. It is therefore important to consult the label when control of a variety of species is desired.

To determine what pesticide may be used it is necessary first to identify the species of nuisance vegetation present.

Some references which may be useful in aquatic plant and algae identification have been appended.

If difficulty arises in identifying particular nuisance plants or algae, a sample of the plant material may be submitted by mail or visit to the Pesticides Control Section for identification. Packaging of the plant samples in a little water to prevent decomposition is recommended.

4. WHEN TO TREAT

Algae and rooted submergent plants should be treated during the spring or early summer while the plants are developing rapidly and before they reach nuisance proportions. During this period, the chemical will be assimilated readily by the juvenile plants. There will be less likelihood that fish mortalities will be caused by oxygen depletion, which can result from the decomposition of a large plant mass. Algicides and herbicides are generally more effective in warmer water and better control will be achieved if the water temperature is over 65°F. In many lakes this temperature is never reached or may occur only in late summer. Therefore, time of treatment should be correlated with stage of maturity of the plant and not water temperature.

Control of emergent vegetation should likewise be undertaken during mid to late summer on days that are calm and sunny. Windy weather increases the hazard to the person applying the chemical and to nearby valuable plants. If rain falls shortly after a spray is applied it will wash the chemical off the plants, thereby reducing the effectiveness of the treatment.

The efficacy of a pesticide often varies with light intensity. In some cases treatment is best timed for bright sunlight; for other pesticides, treatment must be undertaken at dusk or under heavy cloud cover for optimal results since these materials are photosensitive and will decompose in bright light. Read the label carefully for instructions.

5. CALCULATION OF WATER VOLUMES AND DOSAGE RATES

When control of submerged plants is attempted using liquid formulations, it is essential to know the volume of water present in the area to be treated. The surface area must be calculated and the average depth should be determined by adequate sounding.

To determine the volume and total weight of water in the area to be treated, the following procedure is used:

Length x width x average depth = Volume in cubic feet

Volume in cubic feet x 62.4 lbs, = Total weight of water

(1 cubic foot of water weighs 62.4 pounds)

NOTE: If area is measured in acres, 1 acre = 43,560 sq.ft.

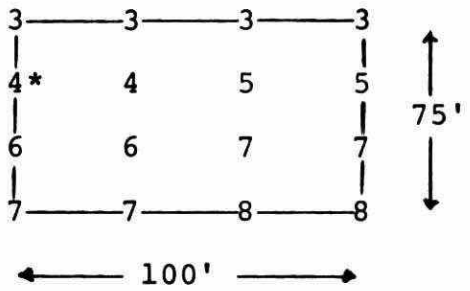
Effective concentrations of a herbicide or algicide are expressed as so many parts of active chemical per million parts of water on a weight per weight basis. Many chemicals are not sold in a pure state but are marketed as water or oil-base solutions or are impregnated in granules of inert materials. Therefore, it is imperative to know the percentage of pure active ingredient(s) in the product to be used. This information is provided on the label of the container in which the chemical is sold.

Recommended concentrations, expressed as parts per million (one pound of active chemical per million pounds of water = 1 ppm) are usually provided by the manufacturers or suppliers of control products.

The following formula is used to calculate the number of pounds of active chemical required:

$$\frac{\text{Total weight of water in lbs. x recommended concentration of active chemical in ppm}}{1{,}000{,}000}$$

EXAMPLE: Calculate the number of pounds of 20% active chemical which are required to treat the plot illustrated below, at a concentration of 2 ppm.



* The varying depths in the above diagram are indicated by different numbers, i.e. 4 = 4 feet in depth, 7 = 7 feet in depth, etc.

Total area = 7,500 sq.ft.

Average depth = 5.4 feet

Total water weight = 40,500 x 62.4 = 2,527,200 lbs.

Applying the formula:

$$\frac{\text{Total weight of water x recommended concentration of active chemical in ppm}}{1{,}000{,}000}$$

$$\frac{2{,}527{,}200 \times 2}{1{,}000{,}000} = 2.5 \times 2 \text{ or } 5 \text{ lbs. of active chemical}$$

Therefore, since this particular material is only 20% active, 25 lbs. of the commercial product would be required. Remember that this is an example only and one has to make all the proper calculations for any plot to be treated, based on the pertinent areas and depths and the particular chemical to be used.

Producers of some granular or liquid herbicidal products recommend application rates based on pounds or gallons per acre, regardless of the depth of water present. Since granules drop to the bottom of the lake or pond, recommendations of this nature are based on the premise that the chemical is absorbed through the roots of the plants.

Where emergent species are treated with contact sprays, the manufacturer's instructions should be followed concerning the percentage solution required to provide effective control. Since the chemical is sprayed directly on the plants, it is not necessary to calculate the weight of water in the pond. It should be remembered that the recommended percentage solution may be based on the active ingredient(s) rather than the commercial formulation.

Before any commercial applicator undertakes a control programme, he must first visit the area to be treated to obtain information for completing the permit application form. As required in all permit applications, persons living adjacent to the property where the herbicide is to be applied must be advised and their approval solicited.

Chemical methods of control are the most practical considering the ease with which they can be applied. However, the herbicides and algicides currently available generally provide control for only a single season. A satisfactory algicide or herbicide must kill the plant or plants causing a nuisance, should not affect fish or other aquatic life, and should be reasonable in cost.

At the present time there is no one pesticide which will adequately control all species of algae and other aquatic plants. In selecting a particular pesticide, the species for which control is desired must be considered, as well as the temperature and chemical properties of the water.

6. TREATMENTS

Recommended pesticides for aquatic vegetation control in Ontario are revised annually in the Ontario Ministry of Agriculture and Food publication 75 "Guide to Chemical Weed Control". Reference should be made to this publication for current recommendations.

NOTE:

The registered uses of the recommended compounds are being revised in compliance with the Federal Pest Control Products Regulations (SOR/72-451) and verification of any of these suggested uses should be obtained from the product label, manufacturer, or Pest Control Product Section, Agriculture Canada representative prior to actual treatment.

7. METHODS OF APPLICATION

For larger projects, where submergent plants are being treated, a power-driven pump mounted in a boat may be used. The pump should be fitted with a dual intake so that the pesticide can be diluted by water taken in through a hose attached to a foot valve, which is suspended over the side of the boat. The diluted pesticide should be injected underwater through a distribution boom fitted with weighted trailing hoses. Poor control has been recorded with this method where bottom sediments have been disturbed by propellor action.

When using a boat on smaller areas, liquid compounds which are not dangerous to handle may be diluted to a 5% solution and added in a regulated flow to the slip-stream of the outboard motor. The action of the propellor will tend to disperse the pesticide. A more effective technique involves the use of a simple boat bailer which is available on request through most of the larger herbicide outlets. This consists of a plastic tube attached to a cone-shaped device that may be clamped to the lower cavitation blade of an outboard motor. The end of the tube is inserted into a drum containing the herbicide, which is drawn out by suction and distributed uniformly by prop action. Again, care has to be taken with use of a motorized boat in shallow water.

Granular products may be applied using a rotary-type seeder, with care being taken to ensure an even distribution of the material. Copper sulphate, which is often used effectively for control of filamentous algae scums, is a crystalline material which should not be allowed to get in the eyes. This chemical should be dissolved and applied as a liquid using spray equipment or placed in a burlap bag and dragged behind a power boat. The speed at which the boat is operated should be related to the rapidity at which the dissolved chemical passes from the bag into the water. Deeper water should receive proportionately more chemical. For control of bottom growths of muskgrass (*Chara sp.*) and filamentous green algae, coarse granular copper sulfate should be seeded in a similar manner as recommended for other granular products. Gravity will thus carry the material directly to the nuisance plants on the bottom.

Emergent aquatic plants may be sprayed using a back-pack sprayer, of the kind used to spray weeds in lawns. All of the exposed foliage should be thoroughly wetted and the addition of household detergent or commercial wetting agent to the spray detergent is sufficient for fifty gallons of spray. Follow directions on the label when mixing a pesticide with a commercial wetting agent; not all mixes are compatible. Before adding any additional wetting agent, consult the label of the pesticide to be used. Many products contain a sticker or wetting agent in the manufactured product and such further additions are unnecessary.

Orchard-type guns may be used for spraying emergents on larger areas and aircraft have been used with success to apply chemicals to cattails and other emergent plants where the size of the area sprayed has warranted the use of this method.

8. GENERAL SUGGESTIONS CONCERNING USE OF HERBICIDES AND ALGICIDES

Before any chemical control measures are undertaken, all land owners adjacent to and in the general vicinity of the treatment area should be notified. Due consideration must be given to any objections voiced by other parties who may utilize water from the surrounding area for drinking, swimming, fishing, watering domestic animals and irrigation. Use of treated water for one or many of these purposes following any application should be restricted in accordance with directions provided by the manufacturer or supplier of the chemical.

Where fish are present and there is a heavy growth of algae or aquatic plants, the entire pond should not be treated at one time. As mentioned previously, decomposition of a large plant mass can lead to depletion of the dissolved oxygen supply so that the fish will suffocate. Under such circumstances, several sectional applications should be undertaken, spaced about a week apart.

Where algicides or herbicides are actually mixed with or distributed throughout the water, it is imperative that an even distribution of the chemical be effected throughout the area to be treated. If localized high concentrations develop, destruction of fish and other aquatic life may result and spotty control of the plants will be achieved. The amount of chemical applied should be in proportion to the depth of water throughout the area to be treated. Problems related to situations where less than effective control is obtained, have arisen where very small areas of water have been treated with an appropriate quantity of pesticide; dilution by water movement from adjacent areas has reduced the concentration of the pesticide below an effective level for many plant species. This problem must be considered when deciding on the size of a treatment area or quanitity of material to be applied.

Since certain herbicides and algicides must be handled carefully because of their toxic properties and sometimes corrosive nature, the specifications for use which are provided by the manufacturer or distributor should be followed closely.

Once an aquatic vegetation control programme has been proposed, approved and implemented, it is very important to observe and document its results. This information recorded with the procedure is invaluable for future reference with respect to both repeating the programme and instituting improvements if the control achieved was less than satisfactory.

Further information on aquatic plant and algae control, licence and permit application forms may be obtained by contacting:

Ontario Ministry of the Environment,
Pesticides Control Section,
135 St. Clair Avenue West,
Suite 100,
TORONTO, Ontario, M4V 1P5

TELEPHONE: (416) 965-2401.

Some references which may be useful in aquatic plant identification:

1. Fassett, Norman C., "A Manual of Aquatic Plants", University of Wisconsin Press, 1969, 403 pp.

2. Hotchkiss, Neil, "Common Marsh, Underwater and Floating Leaved Plants of the United States and Canada", Dover Publications Inc., 1972, 124 pp.

3. Muenscher, W. C., "Aquatic Plants of the United States", Comstock Publishing Co. Inc., 1944, 374 pp.

4. Ontario Ministry of the Environment, "Aquatic Plant and Algae Control", 1975.

5. Otto, N. E., "Aquatic Pests on Irrigation Systems", U.S.D.I. Water Resources Technical Publication, 1972, 72 pp.

6. Prescott, G. W., "How to Know the Aquatic Plants", Wm. C. Brown Co. Publishers, 1969, 171 pp.

Some references which may be useful in fresh-water algae identification:

1. Palmer, C. M., "Algae in Water Supplies", USDHEW, Public Health Service Publication # 657, 1962, 88 pp.

2. Smith, G. M., "The Fresh-water Algae of the United States", McGraw-Hill, 1950, 719 pp.

QUESTIONS ON HERBICIDES STUDY COURSE

AQUATIC VEGETATION CONTROL

1. (a) What Provincial Act is concerned with regulation of the use of aquatic pesticides?

   (b) Under what conditions is a person exempt from a water extermination licence?

   Similarly, under what conditions is a person exempt from an aquatic nuisance control permit?

   (c) List examples of the four possible conditions of a water extermination as it applies to licence and permit requirements and exemptions.

2. What are the three major categories of aquatic plants? Indicate their basic differences?

3. Indicate the best time for treating submergent aquatic plants, providing three supporting reasons for your answer.

4. (a) Indicate the recommended chemical for controlling filamentous algae and the rate at which it is used.

(b) Name two pesticides effective for controlling species of submergent aquatic vegetation.

(c) Name one chemical that will control both filamentous algae and most submergent aquatics and indicate the recommended rates of active ingredient that should be applied.

5. (a) Explain or illustrate how the total weight of water for any area to be treated is calculated.

(b) Name one herbicide used for controlling submergent aquatic plants for which a calculation of the total weight of water is not required and indicate the recommended rate of application for this chemical.

6. Indicate two reasons why an even distribution of an aquatic herbicide is essential.

7. Outline the various methods that may be used to apply chemicals for controlling the three major groups of aquatic plants.

8. List four ways in which aquatic plants and algae play a beneficial role and four undesirable features associated with excessive growths.